Compiler Design HW2 - Scanner

B11001035 劉家成

Introduction:

In this homework, we created lex file to scan through the object file and generate components into tokens.

How to use the file:

Note: This program is recommended to run in ubuntu environment.

1. Open terminal in linux.
2. Type “make” to flex and compile the file (The executable file is scanner).
3. Type “./scanner <TARGETFILE>” to execute the scanner
   EX: ./scanner sample1.qv
4. The result should be printed on the terminal.
5. You can use “make clean” to remove the lex.yy.c file and scanner file.

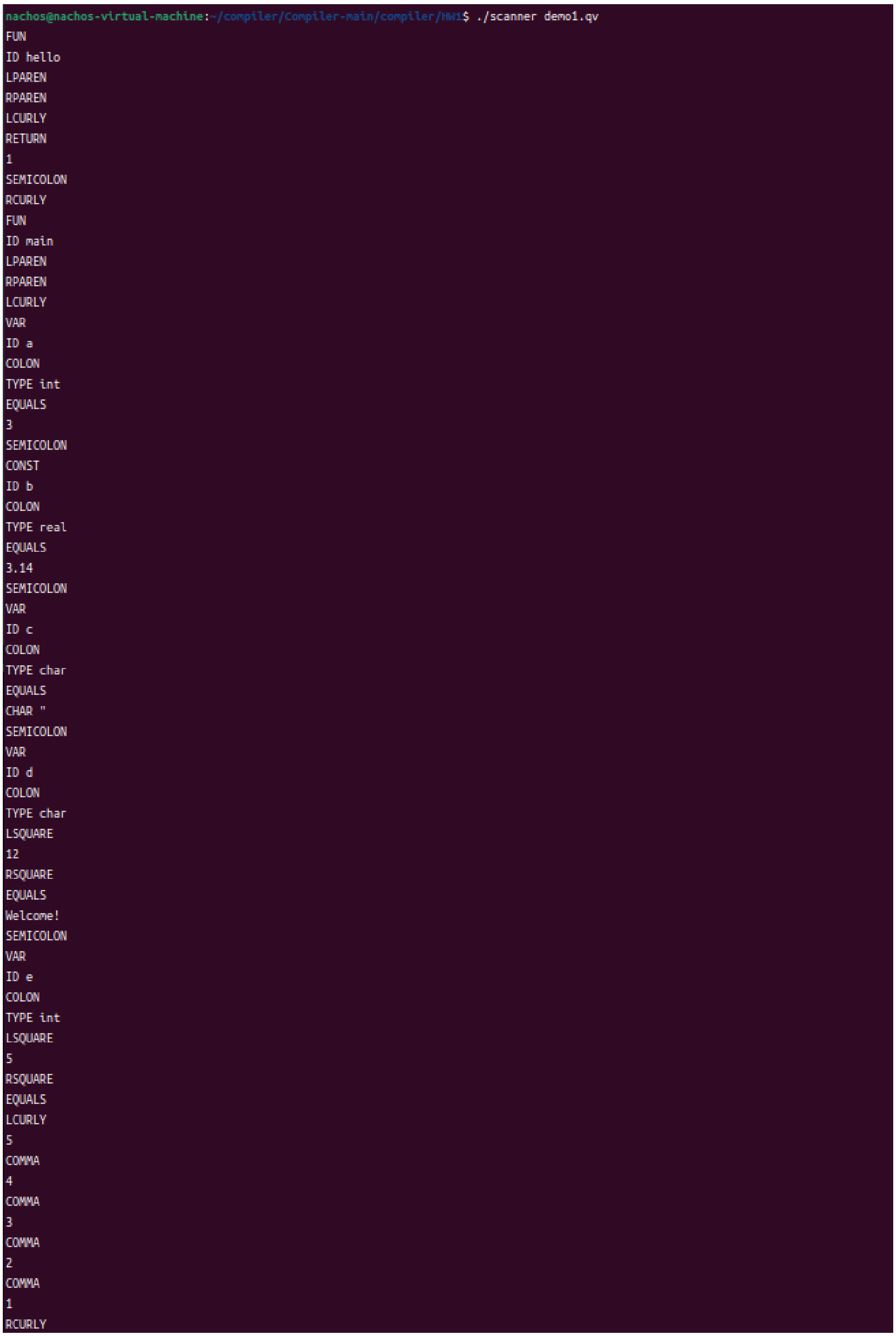
Example Inputs/Outputs:

Example 1 (demo1.qv):

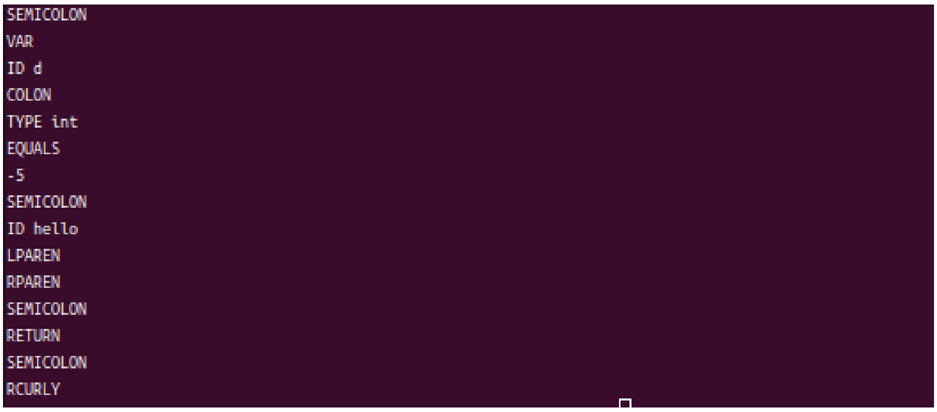
```
fun hello() {
    ret 1;
}

fun main() {
    var a: int = 3;
    val b: real = 3.14;
    var c: char = '\"';
    var d: char[12] = "Welcome!";
    var e: int[5] = {5,4,3,2,1};
    var d: int = -5;
    /* Test multiple
      comments */
    hello();
    ret;
}
```

Overview: A code that has no microsyntax error.

Output:



```
nachos@nachos-virtual-machine:~/compiler/Compiler-main/compiler/HW1$ ./scanner demo1.qv
FUN
ID hello
LPAREN
RPAREN
LCURLY
RETURN
1
SEMICOLON
RCURLY
FUN
ID main
LPAREN
RPAREN
LCURLY
VAR
ID a
COLON
TYPE int
EQUALS
3
SEMICOLON
CONST
ID b
COLON
TYPE real
EQUALS
3.14
SEMICOLON
VAR
ID c
COLON
TYPE char
EQUALS
CHAR "
SEMICOLON
VAR
ID d
COLON
TYPE char
LSQUARE
12
RSQUARE
EQUALS
Welcome!
SEMICOLON
VAR
ID e
COLON
TYPE int
LSQUARE
5
RSQUARE
EQUALS
LCURLY
5
COMMA
4
COMMA
3
COMMA
2
COMMA
1
RCURLY
```



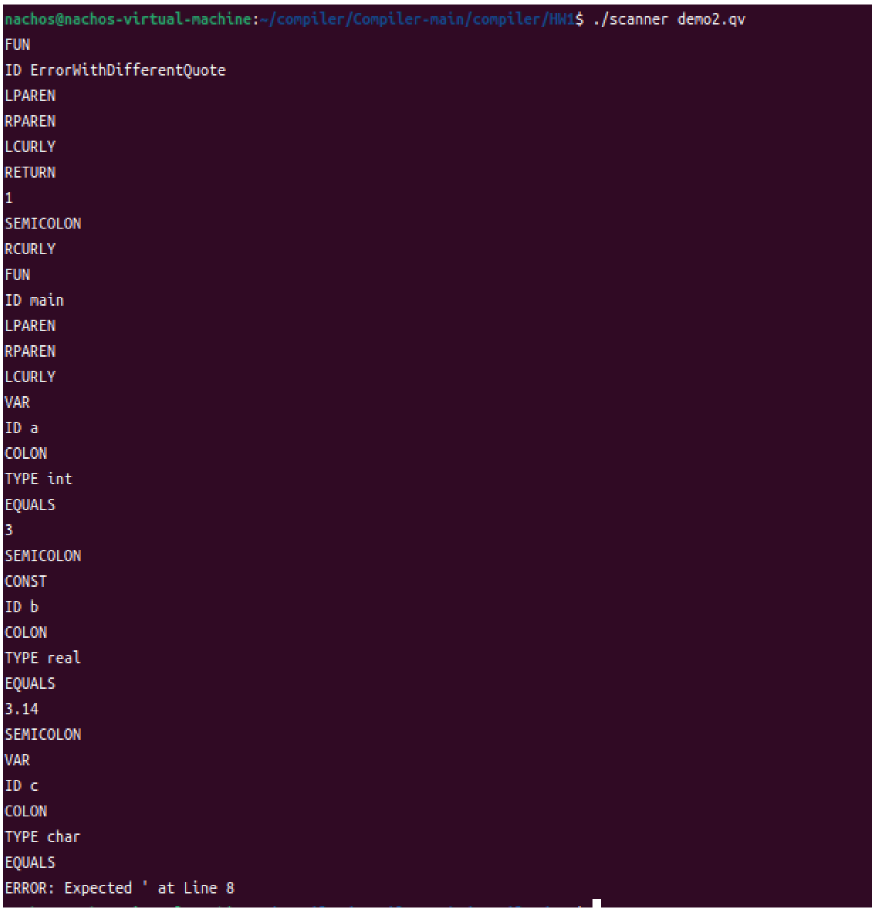
```
SEMICOLON
VAR
ID d
COLON
TYPE int
EQUALS
-5
SEMICOLON
ID hello
LPAREN
RPAREN
SEMICOLON
RETURN
SEMICOLON
RCURLY
```

Example 2 (demo2.qv):

```
fun ErrorWithDifferentQuote() {
    ret 1;
}

fun main() {
    var a: int = 3;
    val b: real = 3.14;
    var c: char = '\""; //Error here
    var d: char[12] = "Welcome!";
    var e: int[5] = {5,4,3,2,1};
    var d: int = -5;
    /* Test multiple
       comments */
    ErrorWithDifferentQuote();
    ret;
}
```

Overview: The code has a different quote at line 8.

Output:



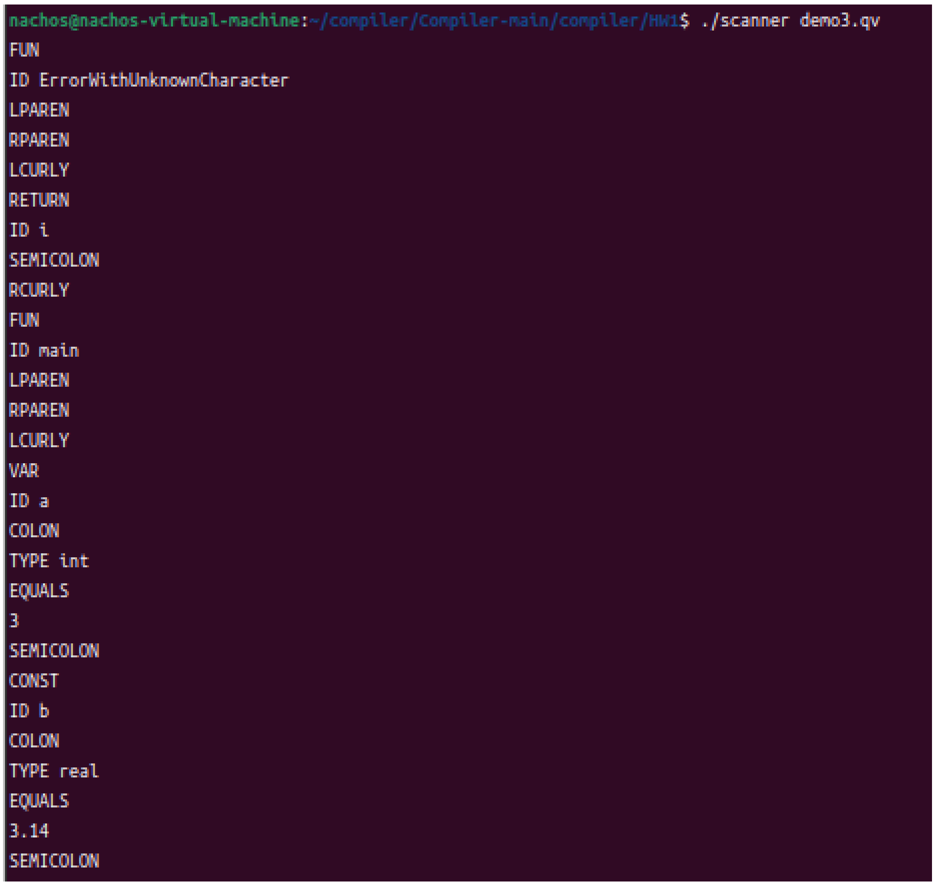
```
nachos@nachos-virtual-machine:~/compiler/Compiler-main/compiler/HW1$ ./scanner demo2.qv
FUN
ID ErrorWithDifferentQuote
LPAREN
RPAREN
LCURLY
RETURN
1
SEMICOLON
RCURLY
FUN
ID main
LPAREN
RPAREN
LCURLY
VAR
ID a
COLON
TYPE int
EQUALS
3
SEMICOLON
CONST
ID b
COLON
TYPE real
EQUALS
3.14
SEMICOLON
VAR
ID c
COLON
TYPE char
EQUALS
ERROR: Expected ' at Line 8
```

Example 3 (demo3.qv):

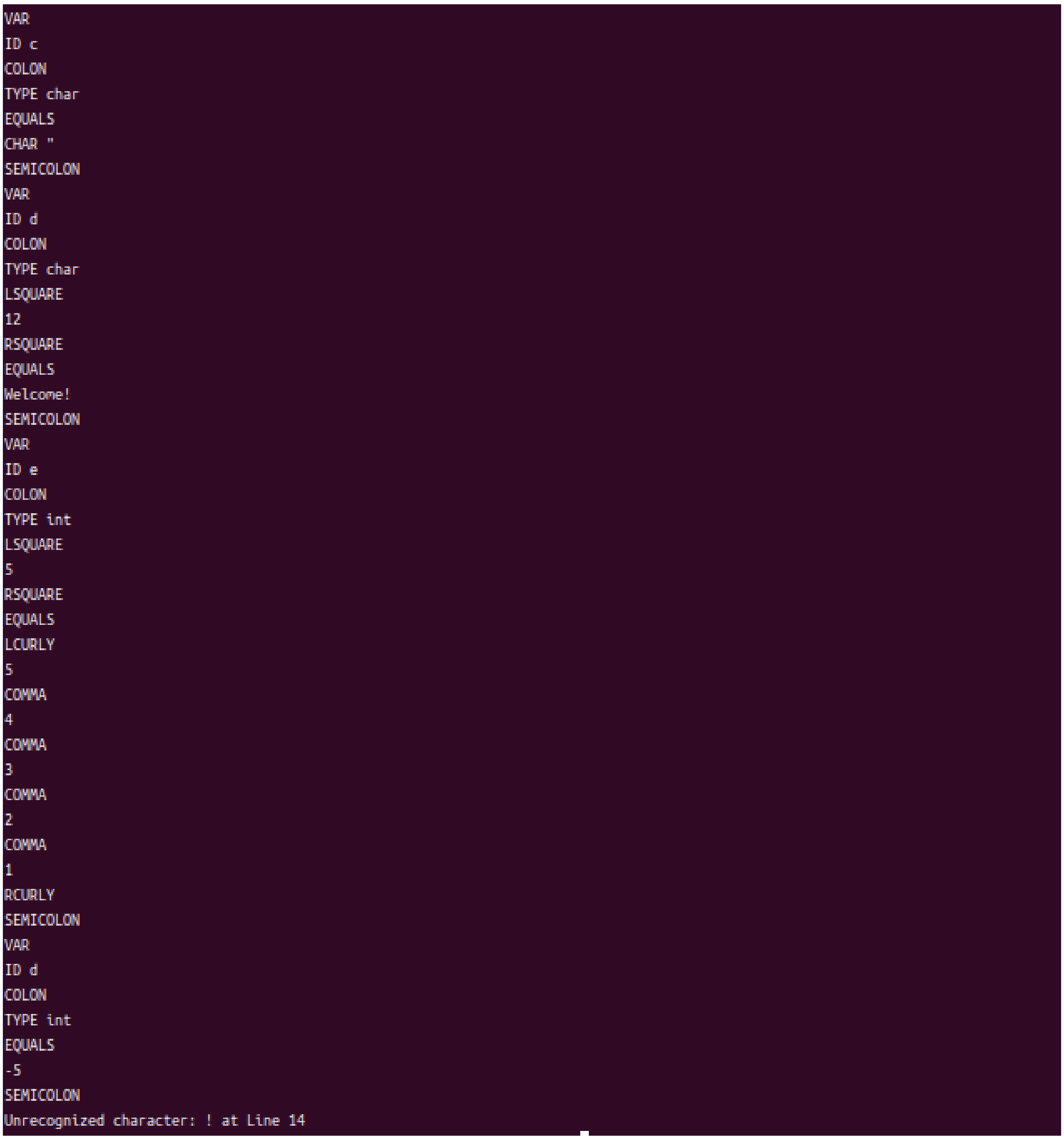
```
fun ErrorWithUnknownCharacter() {
    ret 1;
}

fun main() {
    var a: int = 3;
    val b: real = 3.14;
    var c: char = '\"';
    var d: char[12] = "Welcome!";
    var e: int[5] = {5,4,3,2,1};
    var d: int = -5;
    /* Test multiple
       comments */
    ! //Error here
    ErrorWithUnknownCharacter();
    ret;
}
```

Overview: The quote has an unknown character at line 14.

Output:



```
nachos@nachos-virtual-machine:~/compiler/Compiler-main/compiler/HW1$ ./scanner demo3.qv
FUN
ID ErrorWithUnknownCharacter
LPAREN
RPAREN
LCURLY
RETURN
ID i
SEMICOLON
RCURLY
FUN
ID main
LPAREN
RPAREN
LCURLY
VAR
ID a
COLON
TYPE int
EQUALS
3
SEMICOLON
CONST
ID b
COLON
TYPE real
EQUALS
3.14
SEMICOLON
```



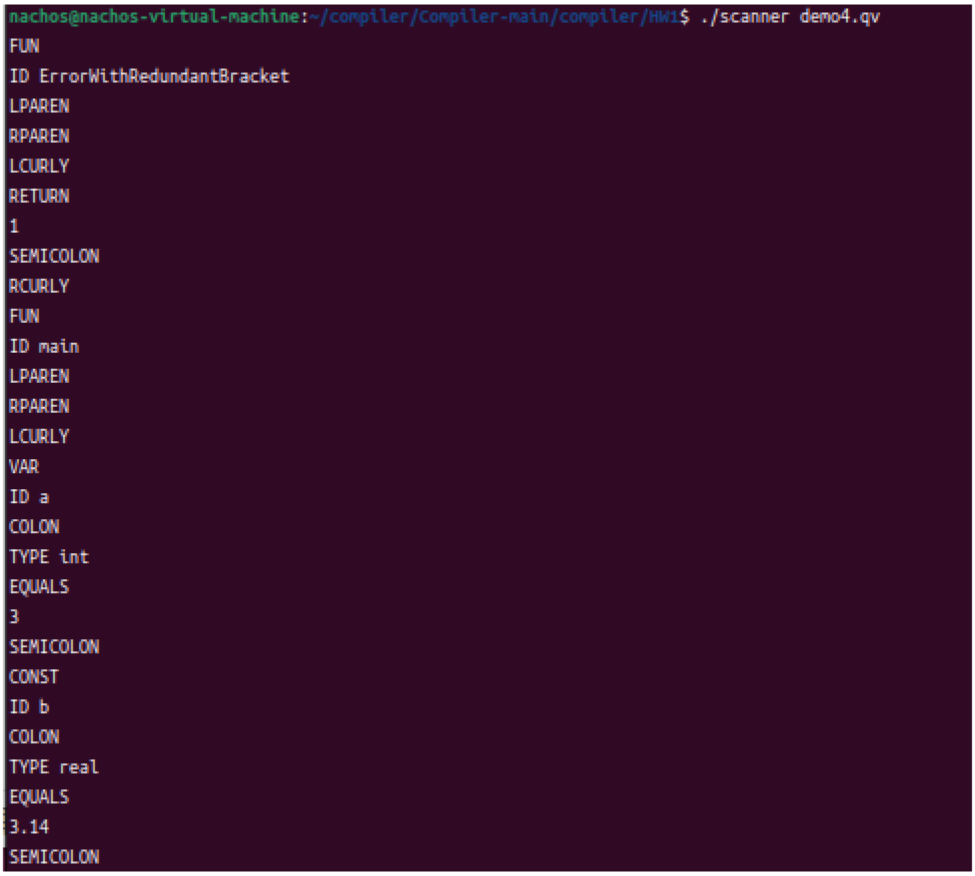
```
VAR
ID c
COLON
TYPE char
EQUALS
CHAR "
SEMICOLON
VAR
ID d
COLON
TYPE char
LSQUARE
12
RSQUARE
EQUALS
Welcome!
SEMICOLON
VAR
ID e
COLON
TYPE int
LSQUARE
5
RSQUARE
EQUALS
LCURLY
5
COMMA
4
COMMA
3
COMMA
2
COMMA
1
RCURLY
SEMICOLON
VAR
ID d
COLON
TYPE int
EQUALS
-5
SEMICOLON
Unrecognized character: ! at Line 14
```

Example 4 (demo4.qv):

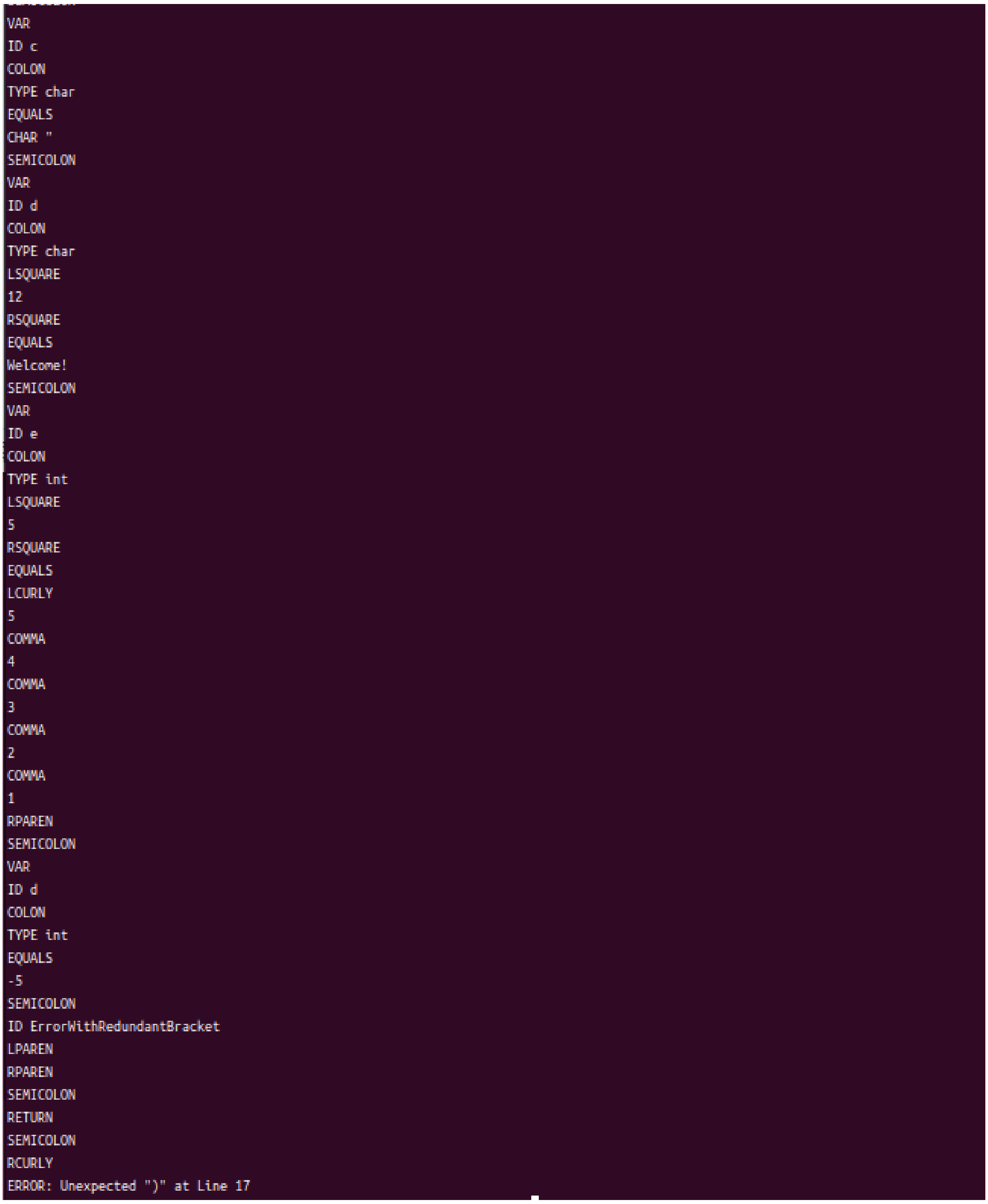
```
fun ErrorWithRedundantBracket() {
    ret 1;
}

fun main() {
    var a: int = 3;
    val b: real = 3.14;
    var c: char = '\"';
    var d: char[12] = "Welcome!";
    var e: int[5] = {5,4,3,2,1); //Error Here
    var d: int = -5;
    /* Test multiple
       comments */
    ErrorWithRedundantBracket();
    ret;
}
```

Overview: The quote has an unexpected character) at line 10.

Output:



```
nachos@nachos-virtual-machine:~/compiler/Compiler-main/compiler/HW1$ ./scanner demo4.qv
FUN
ID ErrorWithRedundantBracket
LPAREN
RPAREN
LCURLY
RETURN
1
SEMICOLON
RCURLY
FUN
ID main
LPAREN
RPAREN
LCURLY
VAR
ID a
COLON
TYPE int
EQUALS
3
SEMICOLON
CONST
ID b
COLON
TYPE real
EQUALS
3.14
SEMICOLON
```



```
VAR
ID c
COLON
TYPE char
EQUALS
CHAR "
SEMICOLON
VAR
ID d
COLON
TYPE char
LSQUARE
12
RSQUARE
EQUALS
Welcome!
SEMICOLON
VAR
ID e
COLON
TYPE int
LSQUARE
5
RSQUARE
EQUALS
LCURLY
5
COMMA
4
COMMA
3
COMMA
2
COMMA
1
RPAREN
SEMICOLON
VAR
ID d
COLON
TYPE int
EQUALS
-5
SEMICOLON
ID ErrorWithRedundantBracket
LPAREN
RPAREN
SEMICOLON
RETURN
SEMICOLON
RCURLY
ERROR: Unexpected ")" at Line 17
```

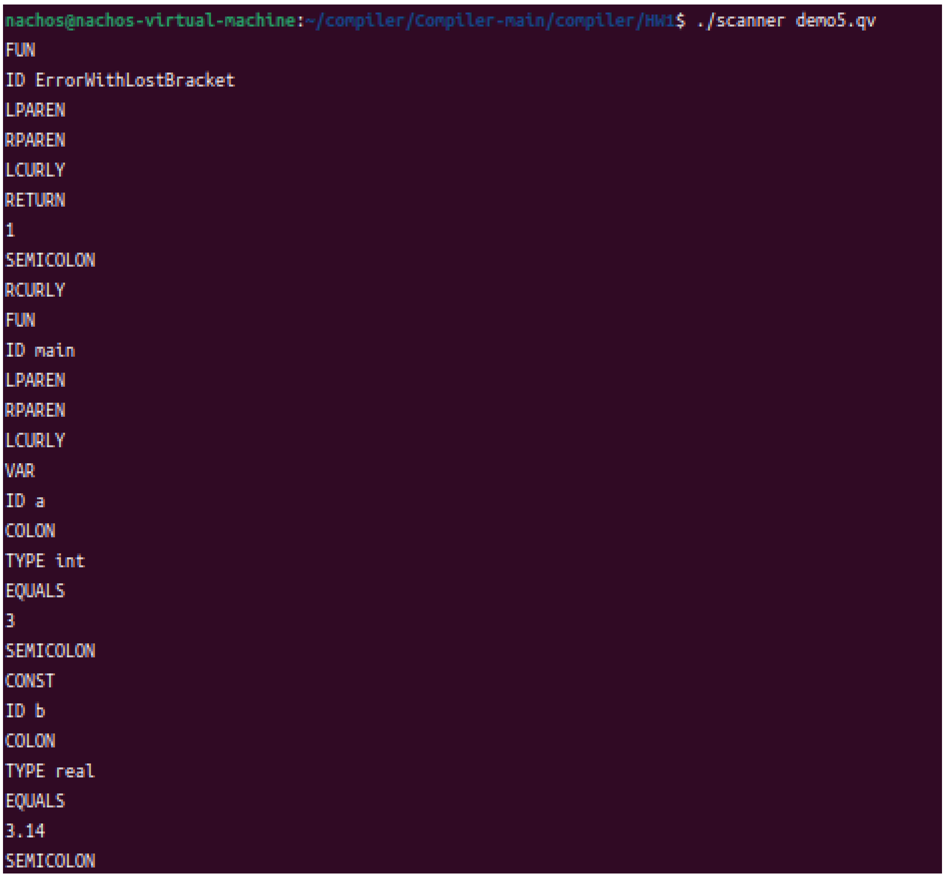
Note: We cannot find the exact line of error at this stage, but we will deal with this problem in the parser.

Example 5 (demo5.qv):

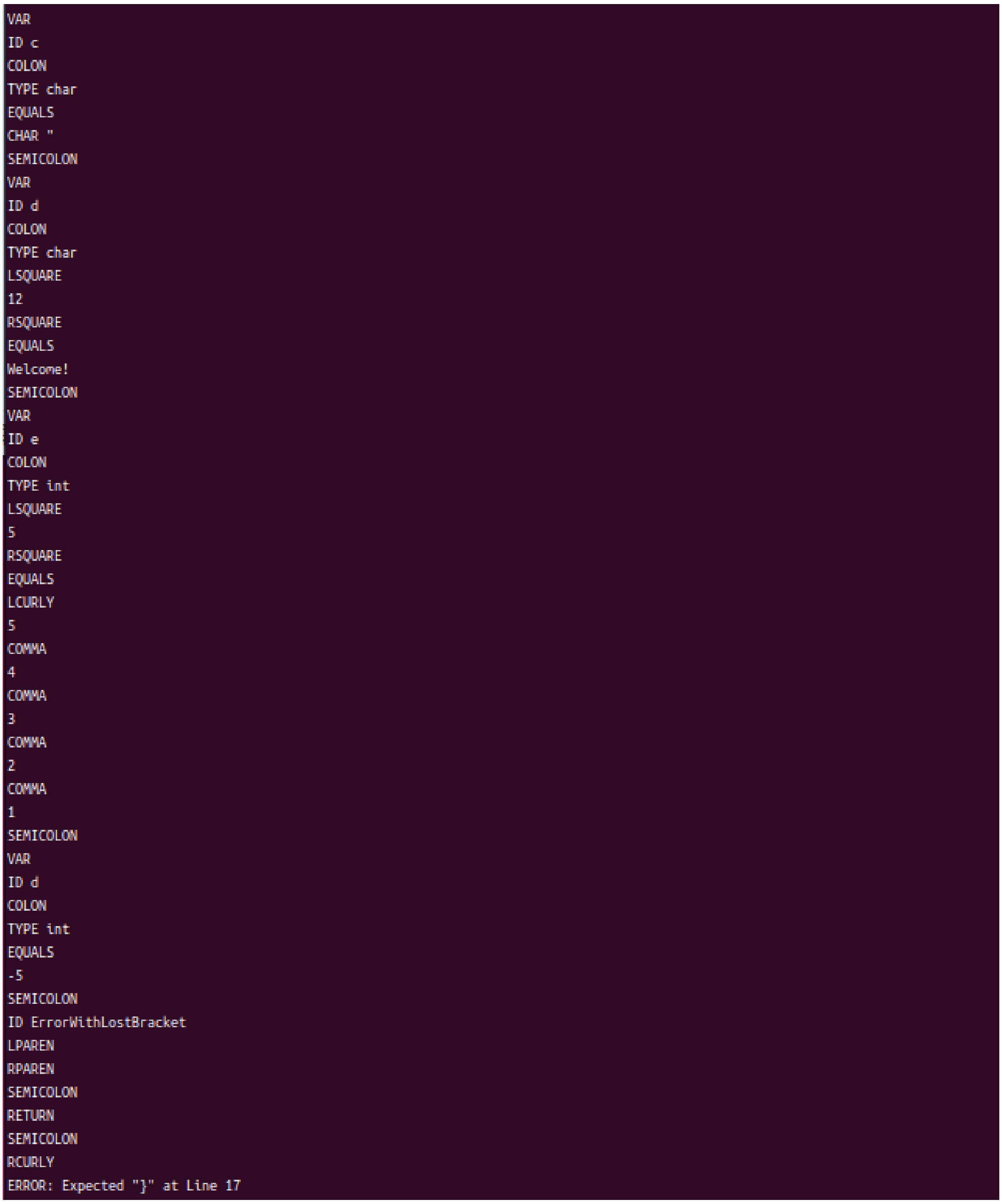
```
fun ErrorWithLostBracket() {
    ret 1;
}

fun main() {
    var a: int = 3;
    val b: real = 3.14;
    var c: char = '\"';
    var d: char[12] = "Welcome!";
    var e: int[5] = {5,4,3,2,1; //Error Here
    var d: int = -5;
    /* Test multiple
       comments */
    ErrorWithLostBracket();
    ret;
}
```

Overview: The quote has an unmatched bracket { at line 10.

Output:



```
nachos@nachos-virtual-machine:~/compiler/Compiler-main/compiler/HW1$ ./scanner demo5.qv
FUN
ID ErrorWithLostBracket
LPAREN
RPAREN
LCURLY
RETURN
1
SEMICOLON
RCURLY
FUN
ID main
LPAREN
RPAREN
LCURLY
VAR
ID a
COLON
TYPE int
EQUALS
3
SEMICOLON
CONST
ID b
COLON
TYPE real
EQUALS
3.14
SEMICOLON
```



```
VAR
ID c
COLON
TYPE char
EQUALS
CHAR "
SEMICOLON
VAR
ID d
COLON
TYPE char
LSQUARE
12
RSQUARE
EQUALS
Welcome!
SEMICOLON
VAR
ID e
COLON
TYPE int
LSQUARE
5
RSQUARE
EQUALS
LCURLY
5
COMMA
4
COMMA
3
COMMA
2
COMMA
1
SEMICOLON
VAR
ID d
COLON
TYPE int
EQUALS
-5
SEMICOLON
ID ErrorWithLostBracket
LPAREN
RPAREN
SEMICOLON
RETURN
SEMICOLON
RCURLY
ERROR: Expected "}" at Line 17
```

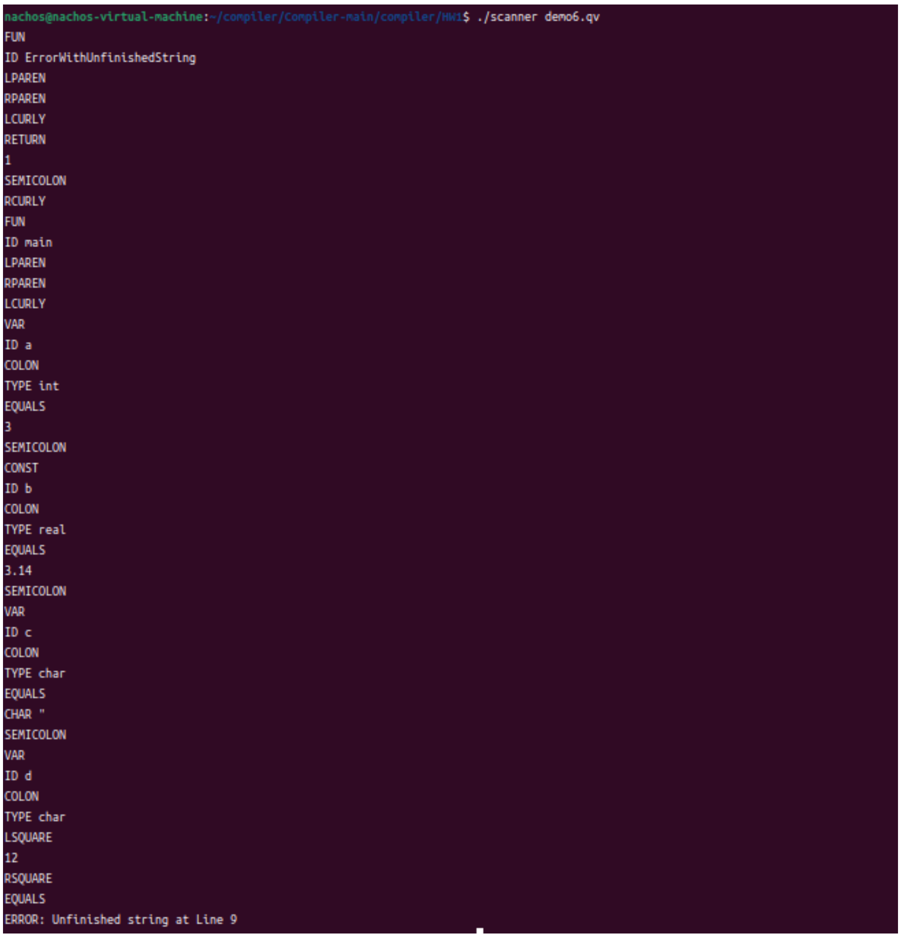
Note: This example has similar problem with example 4, we will also deal with it at the parser stage.

Example 6 (demo6.qv):

```
fun ErrorWithUnfinishedString() {
    ret 1;
}

fun main() {
    var a: int = 3;
    val b: real = 3.14;
    var c: char = '\"';
    var d: char[12] = "Welcome!; //Error Here
    var e: int[5] = {5,4,3,2,1};
    var d: int = -5;
    /* Test multiple
       comments */
    ErrorWithUnfinishedString();
    ret;
}
```

Overview: The quote has an unfinished string at line 9.

Output:



```
nachos@nachos-virtual-machine:~/compiler/Compiler-main/compiler/HW1$ ./scanner demo6.qv
FUN
ID ErrorWithUnfinishedString
LPAREN
RPAREN
LCURLY
RETURN
1
SEMICOLON
RCURLY
FUN
ID main
LPAREN
RPAREN
LCURLY
VAR
ID a
COLON
TYPE int
EQUALS
3
SEMICOLON
CONST
ID b
COLON
TYPE real
EQUALS
3.14
SEMICOLON
VAR
ID c
COLON
TYPE char
EQUALS
CHAR "
SEMICOLON
VAR
ID d
COLON
TYPE char
LSQUARE
12
RSQUARE
EQUALS
ERROR: Unfinished string at Line 9
```